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XPS studies of MgO based magnetic tunnel junction structures
JOHN READ, Cornell University, PHIL MATHER, Cornell, EILEEN TAN, TDSI, Singapore, ROBERT BUHRMAN, Cornell — The very high tunneling magnetoresistance (TMR) obtained in MgO magnetic tunnel junctions (MTJ)[1,2] motivates the investigation of the electronic properties of the MgO barrier layer and the study of the ferromagnetic metal - MgO interface chemistry. Such large TMR values are predicted by theory due to the high degree of order apparent in the barrier and electrode materials. However, as grown ultra-thin MgO films generally contain defects that can influence electron transport properties through the creation of low energy states within the bulk MgO band-gap. We will report the results of x-ray photoelectron spectroscopy (XPS) studies of (001) textured ultra-thin MgO layers that are prepared by RF magnetron sputtering and electron beam evaporation on ordered ferromagnetic electrodes and in ordered MTJ structures with and without post growth vacuum annealing. XPS spectra for both MgO deposition techniques clearly indicate a surface oxygen species that is likely bound by defects in the oxide[3] in half-formed junctions and improvements in MgO quality after counter electrode deposition. We will discuss our results regarding the chemical properties of the oxide and its interfaces directed towards possibly providing guidance to engineer improved MgO MTJ devices. [1] S.S.P. Parkin et. al., Nature Materials, **3**, 862 (2004). [2] S. Yuasa et. al., Nature Materials, **3**, 868 (2004). [3] E. Tan et. al. , Phys. Rev. B. , **71**, 161401 (2005).

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